Inequalities in the Academic Benefits of the Advanced Placement Program

Research Thesis

Presented in partial fulfillment of the requirements for graduation with research distinction in Economics in the undergraduate colleges of The Ohio State University

by

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April 2019

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1 Abstract

The Advanced Placement Program was established during the Cold War to give advanced students early exposure to college-level material under the guise of increasing competitiveness with the Soviets. Since 2000, however, the number of AP exams taken throughout the United States has swelled to more than five million annually (College Board 2018), leaving many to question the effectiveness of the program. This paper uses district-level data from Ohio high schools to analyze the disparities in outcome resulting from the divide between high-income and low-income schools in access to AP courses. Using a fixed-effects model, we argue that an increase in AP participation rates in low-income districts does not significantly affect future college enrollment rates. The percentage of students scoring 3 or above on the AP exam, however, does have a positive effect on college enrollment rates, suggesting that disparities in course quality have a distinct effect on outcomes. Finally, we argue that AP participation has a significant effect on college completion rates for high-income schools but not for low-income schools, which again suggests that course quality is a more important determinant than course quantity, or the simple introduction of more AP courses to a district's curriculum.

2 Introduction

2.1 AP Program

The AP program was created in the early 1950s as a response to fears that American students were falling behind Soviet students. The program was centered predominantly around Yale, Harvard, and Princeton and the surrounding elite prep schools, but it has since spread to a vast number of high schools and universities throughout the country (Tugent 2017). The AP program, in theory, is beneficial to students because it enables them to take college-level classes – and potentially earn college credit – without leaving their high schools. An exam, with scores ranging from one to five, is administered at the end of every AP course, and every public university in Ohio accepts a score of three or higher as a demonstration of adequacy in the subject. Through this program, many students have been able to receive college credit while still in high school, theoretically making a future degree easier and less expensive to obtain.

The problem, however, is that AP courses (and hence AP exams) are much more accessible to students in low-poverty suburban districts than in high-poverty urban districts. Moreover, these exams have become an important factor in the college application process, which greatly disadvantages students who have not had access to these courses when they are applying to universities. Finally, AP courses, as college-level material, are graded on a 5.0 rather than the traditional 4.0 scale, making it possible (and, indeed, very likely) for students with access to AP courses to record grade point averages above

4.0 – a feat that, clearly, is not possible for students without access to AP courses. These students, then, are not only lacking a crucial component of college applications; they also routinely have unweighted, lower GPAs.

The inequalities in the administering of the AP program have not gone unnoticed. Some students, in response to their unequal access to AP courses, have even brought lawsuits against states and school districts. This activism has inspired a movement for "AP for All" programs, or a policy mandating that all districts must provide a certain amount of AP courses to every student. This movement has not been without its share of successes. In recent years, for example, policymakers in Washington, D.C. have implemented a law requiring every high school in the city to provide at least eight AP courses. As another example, Bill de Blasio signed a similar law in New York City, and all high schools in the city must offer at least five AP courses by 2021 (College Board 2018).

As districts throughout the nation consider similar policies, more research must be done to gain a stronger understanding of the potential costs and benefits of expanding the program. Most of the present literature regarding the benefits of AP courses is published by the College Board, the non-profit organization responsible for administering AP courses, and much of it has failed to control for demographics. This paper intends to address that issue by studying the differences in college enrollment and completion rates across demographics in Ohio's school districts.

2.2 College Board Research

The College Board has published a number of studies highlighting the effectiveness of the AP program, and the majority of the research, which is non-experimental, compares AP students and non-AP students. Ultimately, College Board research suggests that AP students outperform non-AP students across a variety of metrics. The College Board has published a handful of studies, for example, demonstrating that AP students generally score higher than non-AP students on standardized tests and are more likely to go to college, get better grades, and graduate than non-AP students (Ewing, Camara, & Millsap, 2006; McKillip & Rawls, 2013; Wyatt & Mattern, 2011; Shaw, Marini, & Mattern, 2013).

Although the College Board research should not be dismissed offhand, many independent researchers have highlighted the obvious conflict of interest. Moreover, the College Board has been criticized for spending more than $4.5 million on lobbying since 2004, and much of this lobbying has pushed for the aforementioned "AP for All" policies(Center of Responsive Politics 2018). In addition, the College Board has been criticized for paying nearly $1.3 million to its CEO in 2009 and $300,000 to 19 other executives (Costello 2009). These numbers are, of course, exorbitant amounts for a non-profit organization, and they highlight the obvious incentives many board members would have to expand the AP program. Research conducted by the College Board, therefore, should not be accepted independently and should instead be considered in conjunction with studies by unaffiliated researchers.

2.3 Non-College Board Research

The amount of independent research examining outcomes of the AP program has grown in recent years. The first significant paper studied the impact that expanding the AP program had on the quality of the AP courses offered, and it concluded that, based on declining AP exam scores, AP students were less prepared than in previous years (Lichten 2000). Another popular study analyzed the power of AP participation rates and exam scores in predicting college GPAs. The study concluded that, after controlling for confounding variables (demographics, SAT scores, high school GPA, etc.), participation in the AP program was not able to accurately predict later college GPAs (Geiser & Santelices, 2004). This existing body of work, while embryonic, suggests that there is a weaker relationship between increased AP participation and future academic success than College Board research suggests (Warne & Anderson 2015). Moreover, the degree of benefits the AP program offers remains unclear.

3 Data

3.1 Overview

The data used in this paper is panel data collected between 2006 to 2017 by the Ohio Department of Education for all high school districts in the state of Ohio. Figure 1 shows the summary statistics for all of the important variables in the database. "AP Participation" represents the percentage of students that

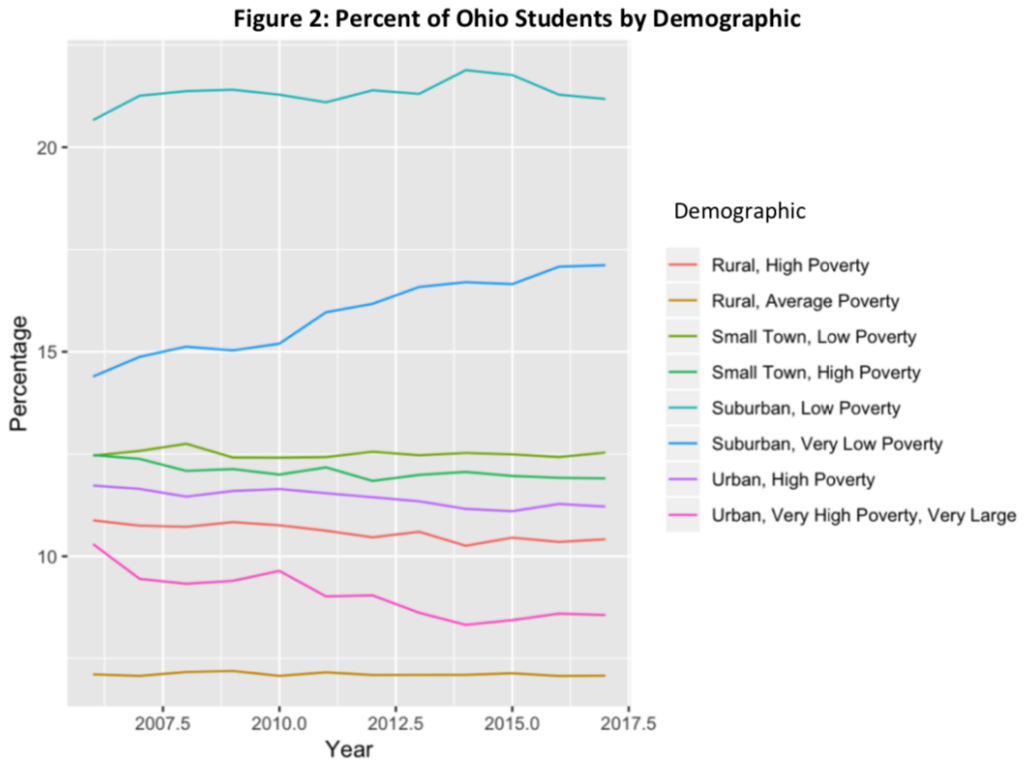
Figure 1: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
AP Participation	3,941	21.583	26.541	0.000	100.000
College Completion	1,821	31.858	13.273	1.500	76.700
College Enrollment	2,428	57.366	12.572	22.800	91.400
Mean ACT Score	4,245	21.549	1.779	0.000	28.000
AP 3 or Above	3,321	28.367	30.190	0.000	97.800

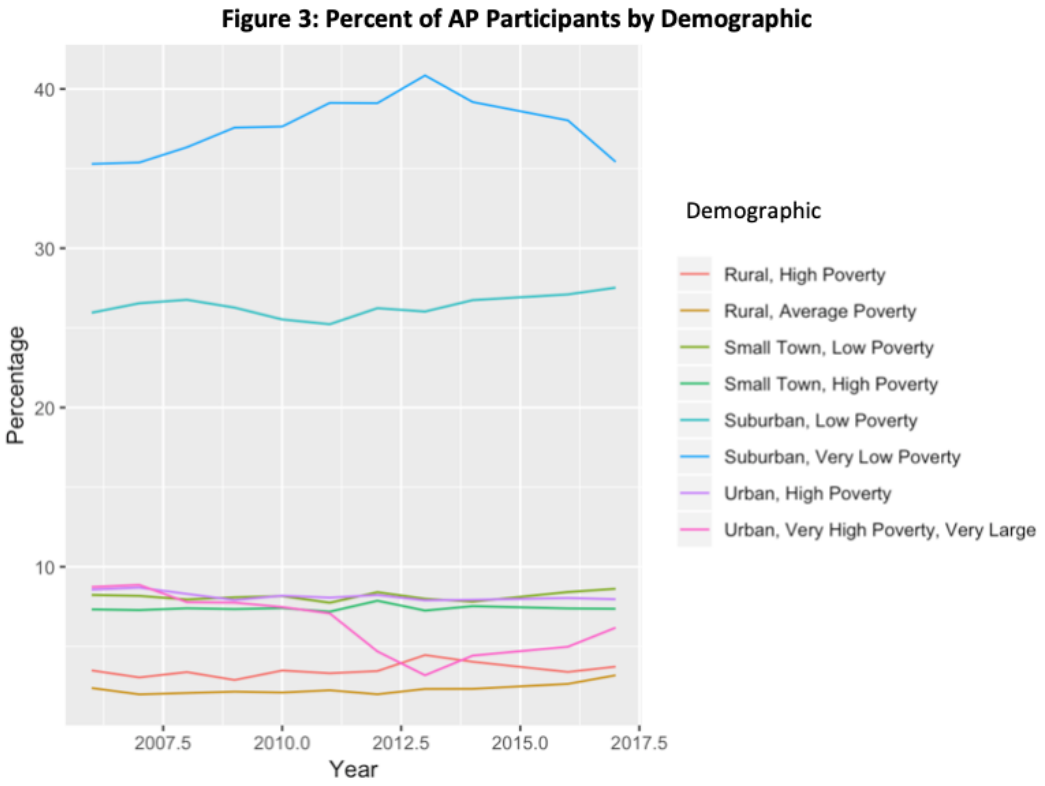
take one or more classes in a school district from 2006 to 2017. (A concern with this variable is that some school districts reported "N/A" in earlier years of the data. Many of these districts reported zero percent participation in the later years, which could bias the data by leaving out low-percentage districts in the regression.) "College Completion" represents the percentage of students graduating college within six years of high school; this data was only available from years 2009 to 2011. "College Enrollment" is the percentage of students enrolled in college within two years of graduating high school between 2012 and 2015. "ACT Mean Score" is the mean ACT score for the school district from 2006 to 2015. Finally, "AP 3 or Above" represents the percentage of the graduating class receiving a three or above on an AP exam. (This variable does not record if a student scores a three, four, or five on the exam.)

3.2 Trends

With district level data spanning over 12 years, it is important to understand the trends in the data before interpreting regressions. Figure 2 graphs



the percentage of the Ohio high school student population made up by each demographic, as defined by the Ohio Department of Education. Very low-poverty, suburban schools have made the largest gains as a proportion of the overall Ohio student body since 2006. Schools in this category have a median district income of $53,233 and an average student minority rate of 12 percent. On the other hand, high-poverty, urban schools, with a median income of $24,716 and an average student minority rate of 70 percent, have seen the largest drop in representation. Figure 3 tracks the trends in the proportion of students participating in the AP program by demographic. Comparing Figure 2 and Figure 3 highlights the stark differences in access to AP courses,



or the "access gap," between demographics. In 2017, suburban, low-poverty schools made up only 17 percent of the overall student body but accounted for 35 percent of students participating in the AP program. These trends have remained relatively consistent through time.

4 Empirical Methodology & Results

4.0.1 College Completion

Understanding the "access gap" makes one question if there would be similar improvements in academic outcomes across all Ohio districts as a result of

simply increasing access to AP courses and, therefore, rates of AP participation. The AP program, however, is very expensive, and, resultingly, it might be an aggregate gain for some districts and not others. Teachers, for example, must be certified to teach AP courses, and this cost could more reasonably be incurred by suburban districts with a large number of students willing to enroll in the courses than in a small, rural school without as many interested students. For this reason, the gains resulting from the introduction or expansion of AP courses could theoretically be higher for suburban schools than rural schools.

To test this, we used the data from 2009 to 2011 to predict college completion rates. We estimated the following fixed-effects model:

$$CollegeCompletion_{d,t} = \beta_0 + \beta_1(APParticipation)_{d,t} + \beta_2(AP3orAbove)_{d,t} + \beta_3(MeanACTScore)_{d,t}$$

We used a fixed-effects model to differentiate between change within the data and increases in the variables. It removes the effect of the correlation between the error term and predictor variables. We also ran a Hausman test, which suggested that the fixed-effects model was a more effective predictor than a random-effects model.

In the model, college completion is the percentage of students that completed college within six years of graduating. The percentage of AP exam takers that scored three or above controls for the differences in quality between AP courses at different schools. (A school that only has 10 percent

Figure 4: The Effects of Increasing AP Participation on College Completion

	College Completion		
	All Districts	Low Poverty Districts	High Poverty Districts
	(1)	(2)	(3)
AP Participation	0.049***	0.057***	0.023
	(0.018)	(0.020)	(0.030)
AP 3 or above	0.024	0.021	0.011
	(0.015)	(0.021)	(0.020)
Mean ACT Score	0.528***	0.272	1.180***
	(0.176)	(0.190)	(0.328)
Observations	1,578	654	673
R^2	0.020	0.027	0.034
Adjusted R^2	-0.551	-0.510	-0.550
F Statistic	6.653*** (df = 3; 997)	3.844*** (df = 3; 421)	4.842*** (df = 3; 419)
Notes:	***p < .01,**p < .05, *p < .10, Standard errors in parenthesis		

of test takers get a three or above, for example, might not prepare students for college as well as schools that have a rate of 50 percent.) Finally, mean ACT score is a useful proxy in controlling for some of the differences between student bodies and demographics.

Figure 4 includes three different regressions. Regression one contains the data from every school district in the state of Ohio. The results suggest that AP participation has a significant effect on college completion rates when controlling for mean ACT score and percentage of students scoring three or higher on the AP exam. When running the regression only on districts that the Ohio Department of Education categorizes as low-poverty, the effects of AP participation are even greater. For high poverty districts, however, the effect is not statistically significant. This suggests that gains from increasing

AP participation are much higher for low- poverty districts, though the effect is small – a 20 percent increase in AP participation only leads to a 1.14 percent increase in college completion on average.

The disparity in results could be related to the reasons mentioned above. It is difficult for low-income schools to fund the AP program; teachers must be certified, and the course must adhere to AP curriculum. Moreover, districts with a smaller student body may not have enough students interested in and qualified to take AP courses, forcing the district to decide between teaching the course to fewer students, thereby spending more money per student, or relaxing the entrance requirements. From 2006 to 2017, the mean rate at which students in low-poverty districts scored three or above on the exam hovered around 45 percent; for high-poverty districts, it was around 20 percent. These results suggest that course quality is more important to student success than simply the existence of the course and could therefore help to explain the difference in returns to AP participation seen in Figure 4.

4.1 College Enrollment

The college completion rate is a good measure of the long-term academic benefits students accrue from taking AP courses, but one must also pay attention to the impact of AP courses on a student's likelihood to enroll in college at all. To this end, the Ohio Department of Education collected data on the graduating classes of 2012 to 2015, in which "college enrollment" is defined as the percentage of high school graduates enrolled in college within two years of graduation. We used a similar fixed-effects model to measure the effect of the

AP program on college enrollment:

$$CollegeEnrollment_{d,t} = \beta_0 + \beta_1(APParticipation)_{d,t} + \beta_2(AP3orAbove)_{d,t} + \beta_3(MeanACTScore)_{d,t}$$

The fixed-effect model captures the increases from within the variables and removes the effect of the error term.

Figure 5 shows the results of all three regressions. The first suggests that the proportion of students scoring three or higher on the AP exam is statistically significant at predicting college enrollment. Upon further analysis of the second and third regressions, however, there is a difference in effects between low-poverty and high-poverty districts. Neither AP participation nor AP exam scores are statistically significant for low-poverty districts, which suggests that the AP program does not encourage students from low-poverty districts to enroll in college. Regression three, however, suggests that scoring three or higher on the AP exam is statistically significant for high-poverty districts, while AP participation is not. The quality of the AP courses, then, plays a role in increasing college enrollment rates for high-poverty schools, although the effect is small.

Finally, Figure 5 suggests that the AP program might lead to increased college enrollment rates for students in high-poverty districts, but simply increasing participation alone is not enough. The quality of the course, as measured by the percentage of students scoring three or higher on the exam, is a critical component. Interestingly, the same does not hold true for students in

Figure 5: The Effects of Increasing AP Participation on College Enrollment

	Enrollment		
	All Districts	Low Poverty Districts	High Poverty Districts
	(1)	(2)	(3)
AP Participation	0.004	0.014	0.027
	(0.011)	(0.011)	(0.025)
AP Three or Above	0.020***	0.004	0.042***
	(0.008)	(0.009)	(0.013)
Mean ACT Score	0.609***	1.038***	0.427
	(0.205)	(0.361)	(0.261)
Observations	1,737	681	758
R^2	0.013	0.020	0.035
Adjusted R^2	-0.520	-0.501	-0.497
F Statistic	4.964*** (df = 3; 1127)	2.996** (df = 3; 444)	5.927*** (df = 3; 488)
Notes:	***p < .01,**p < .05, *p < .10, Standard errors in parenthesis		

low-poverty districts, which could be because a large number of students in these districts have already decided whether they are going to college. Many students in high-poverty districts, in contrast, might be undecided, and scoring a three or higher on the AP exam could give them the confidence to enroll.

5 Conclusion

In response to the rapid expansion of the AP program in the last two decades, increased research and analysis needs to be conducted to ensure that students are achieving optimal academic outcomes. The trends in our data, however, suggest that the AP program has not been effective in lower-income

areas, and it evidently plays a role in the large (and expanding) achievement gap between rural/urban and suburban schools throughout the county. With mounting pressure for state and local governments to expand AP participation, research in the area is critical to ensure that taxpayer money is being effectively spent. This paper examined Ohio school districts and found that the AP program produced disparate results in college enrollment and completion rates in districts with different demographics.

Providing students across the socioeconomic spectrum an opportunity to enroll in college is an indispensable step to begin to close the inequality in academic outcomes. We found that increasing rates of AP participation has no significant effect on rates of college enrollment for either low- or high-poverty districts. The percentage of students scoring three or higher on the AP exam, however, has a small but significant effect on rates of college enrollment for high-poverty districts, but the same is not true for low-poverty districts. A possible explanation could be that students in low-poverty districts are generally more predisposed to enroll in college. Fewer of them would be first-generation students, and they are therefore less responsive to their individual AP course results. In contrast, students in high-poverty areas are less likely to attend college, and they might therefore be more motivated to make a certain decision as a result of their AP courses. Expanding the AP program, then, may be effective at increasing college enrollment rates. An essential component, however, is that the quality of the courses be maintained – and many critics of the AP program do not think this is feasible.

While college enrollment rates simply measure the number of students de-

ciding to enroll in college, college completion rates more accurately measure improvements in student performance. In other words, districts with higher rates of college completion have successfully increased the chances their students' future college success. To this end, we found that AP participation had a small but significant effect on college completion rates for low-poverty school districts but not high-poverty school districts and scoring a three or higher on the AP exam was not a significant determinant of future performance for either low-poverty or high-poverty districts. This could simply be another consequence of qualitative differences between low-poverty and high-poverty schools.

Future research in this area should focus on the differences in the quality of AP courses between districts. In addition, using student-level data instead of district-level data would help to more specifically illuminate individual student outcomes as a result of participation in the AP program, in addition to measuring the differences between students who receive passing scores on AP exams and students who do not. Overall, "AP for All" is an expensive policy that does little to palpably address the massive inequalities between rural and suburban districts. Other programs, such as the dual enrollment program, for example, more effectively increase access to upper-level courses in high-poverty districts, and efforts to expand the AP program do not sufficiently address academic inequalities, and they may even be counterproductive, exacerbating the very inequalities that they ostensible seek to reduce.

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